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POTENTIAL 20 TeV SITE IN ILLINOIS - DE KALB

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The Batavia, Illinois loscation has all the necessary requirements for a major high energy physics laboratory, i.e., near a major airport and road system, many good universities within driving distance, a large pool of technical people in the area, all types of industry nearby, and centrally located. Even with these charactoristics usually associated with urban areas, there also exists nearby open land where perhaps a 20 TeV collider could be located.

Preliminary studies are being made of potential sites in Illinois for a 20 TeV collider. The largest ring that has been looked at has a 25 kilometer radius (30 mile diameter). This was picked since the lowest magnetic field (3 Tesla) would give 20 TeV and smaller rings should be easier to accommodate. The motivation for the siting of this ring was to find a location near Fermilab so that the infrastructure could be used including the Energy Doubler as an injector. One ring considered went through Fermilab and out toward the west. The obvious advantage of this ring would be to have the experimental areas on the Fermilab site. The difficulty with this ring is that it must be quite deep to pass under the Fox river twice. At this time we have only looked in some detail at a site west of the Fox river with an injection line from Fermilab that passes under the river. We call this ring the Dekalb site.

GEOLOGY OF THE DEKALB SITE

Figure 1 illustrates the layout of the Dekalb site with the injection line from Fermilab. The site is bounded on the east and southeast by the Fox river and 50 miles to the northwest by the Rock river. The geology in this area consists of a dolomite (limestone) bedrock covered by 50 to 200 feet of glacial till. In general the topology slopes up from the Fox river to a ridge that goes from Elgin through Dekalb. Figure 2 is a plot of the elevation around the ring shown in figure 1. Recall that a sine wave of wavelength equal to the circumference of the ring is a plane, one can see the two planes in figure 2. This region of Illinois is quite stable and does not have a history of large earthquakes. More detailed studies are being made of the geology in this area.

TUNNELING

There are at least three types of tunneling; (1) cut and fill, (2) soft boring in till, and (3) hard boring in rock. The transition from soft to hard boring is difficult because the boring head must be changed. Very preliminary estimates for a 7 foot diameter tunnel indicate that cut and fill may be as cheap as 300 to 500 dollars per foot and soft boring 600 to 1000. It appears that in the Dekalb region it is not hard to stay in the glacial till and have a planar ring, however, this requires all soft boring. If terrain following is permitted (vertical radius greater than 300 kilometers) then most of the Dekalb ring could be a cut and fill operation (see figure 2). Figure 3 is a plot of the cut and fill required for the ring in figure 1 with three pairs of vertical bends (difference between solid and dashed lines in figure 2). The consequences of a cut and fill operation as far as environmental impact are not understood at this time.

CONCLUSION

At first glance it appears that the Dekalb region is a potential site for a 20 TeV collider. However many aspects remain to be studied in detail; (1) makeup of the glacial tills, (2) location of aquifers, (3) better cost estimates for tunneling, (4) environmental impacts, (5) details of everything in the easement around the ring (within about 500 feet), (6) availability of electrical power, (7) land sites for the service areas, (8) water rights for cooling water, (9) specific accelerator lattices, etc.

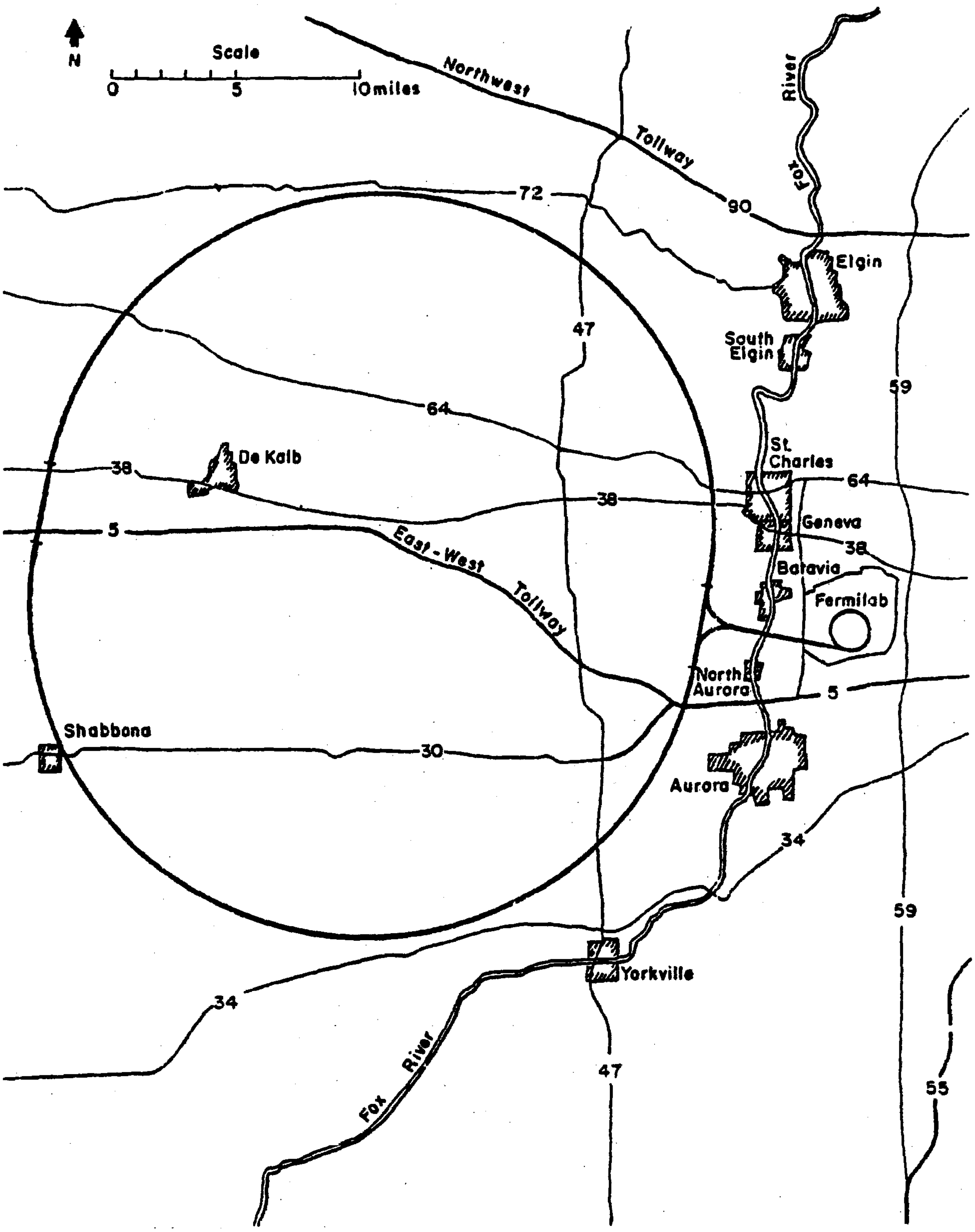

FIGURE 1. Map of the region west of Fermilab with an overlay of a potential site for the 20 TeV collider. The ring circumference is about 100 miles.

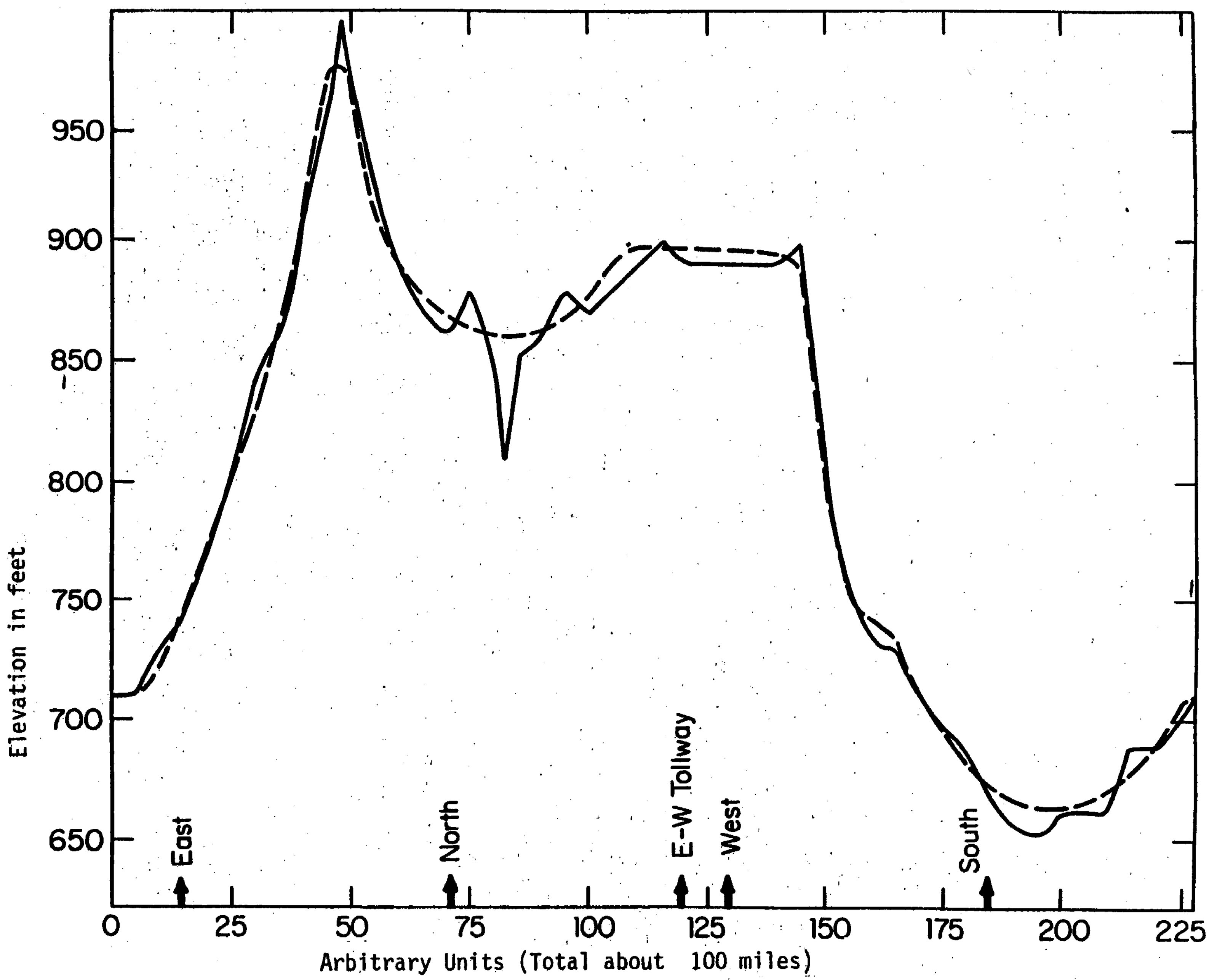

FIGURE 2. Elevation around the ring illustrated in figure 1. The solid curve is the terrain, the dashed curve is a fit with three pairs of vertical bends.

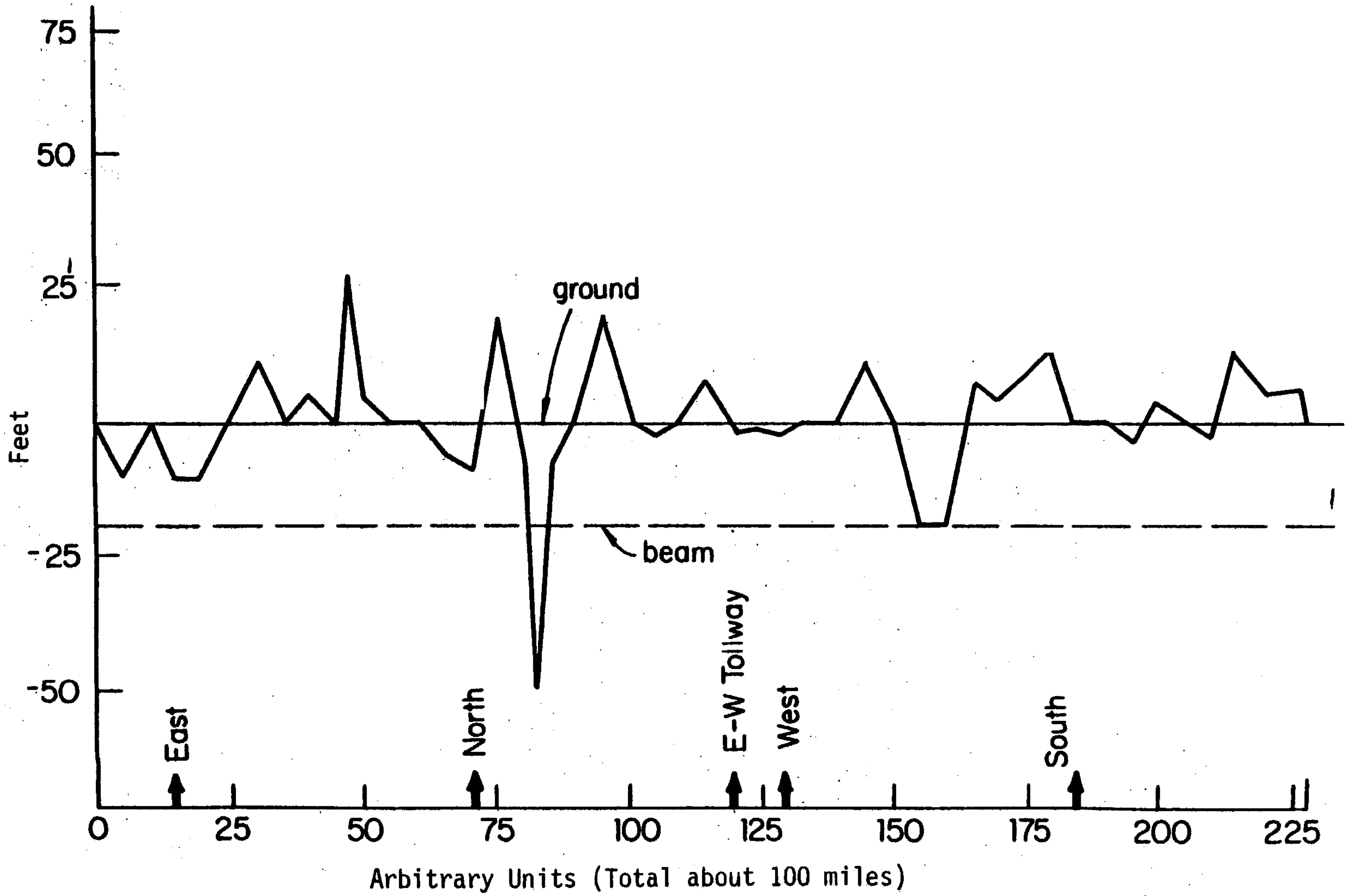

FIGURE 3. Deviations between solid and dashed curves of figure 2. This represents the amount of cut and fill that would be necessary for the ring in figure 1.